GEOGRAPHIC SCHOOL BULLETINS

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Aerial Explorations, Inc.

THE INCAS BUILT AN EMPIRE ON THE ARROGANT LLAMA'S BACK

The long-necked llama, cousin to the camel, is as necessary to Peru's high Andes as the camel to the desert or the reindeer to snowy northern wastes. Domesticated by the Incas, his ability to thrive in the thin air of high altitudes helped them build roads, maintain barter trade, and collect tribute throughout an Indian empire that may have numbered 10,000,000 subjects. One of their magnificent structures was the fortress at Sacsahuaman, near Cuzco, whose walls (background) were fitted together without mortar. The llama will carry 80 to 100 pounds on his back, but balks at more. He refuses to be harnessed to a plow or conveyance. Though still typical, the 650,000 llamas in Peru are now outnumbered by twice as many wool-bearing alpacas, twice as many cattle, and twenty times as many sheep (Bulletin No. 2).

HOW TEACHERS MAY OBTAIN THE BULLETINS

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Tripolitania Again a Desert Battleground of Empires

THE wide and rocky desert reaches of western Libia, where Axis forces have been making their stand, is a last stronghold of the crumbling Italian Empire that reached deep into northeast Africa before the war.

This region is the historic Tripolitania in which Phoenicians planted the power of their early commercial empire, in which the Roman Empire pressed its authority upon rebellious tribesmen, and where most recently the Turkish Empire fell back before Italian pressure.

"Red Hammada" a Desert of Rock

In extent, from the white buildings and green parkways of Tripoli in the north to the bare and sun-blackened sandstone hills of Tummo on the southern frontier, Tripolitania is impressive. Its estimated area of 360,000 square miles, comprising just more than half of the colony of Libia, makes it a hundred thousand square miles larger than the State of Texas. Yet its population would scarcely be equal, by Italian estimates, to twice that of Houston. With Arabs and Berbers outnumbering Europeans 20 to 1, Tripolitania has about 600,000 inhabitants.

Most of the country is still desert, as it was when early sailors dreaded navigating the Gran Sirte, for fear of thirst and starvation if shipwrecked on its barren coasts. A peculiarly desolate patch on Tripolitania's western edge is the Hammada el Homra, the "Red Hammada," where an area the size of the State of Kentucky is covered with clean red rock and worn pebbles, with hardly a vestige of life.

By toiling from oasis to oasis, desert traders have led their caravans across Tripolitania's length since the dawn of history, to reach the Mediterranean coast in the neighborhood of Tripoli. Once they brought gold dust, ivory, and ostrich feathers, and until the present century they carried a considerable contraband cargo of slaves. The caravan routes are still important, since the roads from the Lake Chad area of French Equatorial Africa cross Tripolitania's oases.

Troglodytes Dig Underground Homes in West

The Mediterranean gives Tripolitania a strip of cultivable land along the coast, although the desert pushes to the shoreline along the Gran Sirte. The oases near the sea are productive of olives, oranges, and dates. When the scant rain falls at the right season, there are crops of grain—wheat and barley—as well as a considerable yield of tobacco. In coastal waters are found sponges and fish.

The colony's capital, Tripoli, dominates the coastal sector. The only other port of much importance is Misurata, with about 5,000 inhabitants, although the port of Homs was developing before the war. Fully a sixth of Tripolitania's people live in Tripoli.

South of the coastal plain rises the Jebel, a broken plateau country about 2,000 feet above sea level, where the summers are hotter and drier and the winters are colder. The temperature may rise there to 135 degrees, but frost is not unknown. While invading Arabs, from the 7th century on, took over many of the desirable stretches of the coastal plain, the Jebel remains in large part in the hands of the Berbers, the light-skinned, blue-eyed people who have inhabited North Africa since man began to record his history. Some are troglodytes, making their homes underground, as at Garian in the northwest. Excavating a broad central well,

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PERU'S RICH CITIES ARE STRUNG ALONG THE BARREN COAST

Lima, the capital, has more than a half-million people, and its seaport, Callao, eight miles west, has 75,000. Other important ports include Mollendo, doorway to southern Peru and adjacent Bolivia, and in the north Talara, outlet for the oil fields and the westernmost city of South America. Inland centers are Arequipa, Peru's third-largest city, high in the Andes, and tropical Iquitos, big rubber port 2,000 miles above the Amazon's mouth (Bulletin No. 2).

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Peru, Home of Empire Builders

(This is the seventh of a series of bulletins, with maps and illustrations, on the republics of Latin America.)

IN THE story of the New World, Peru stands for adventure, fabulous wealth, and empire building.

Francisco Pizarro and a handful of gold-hungry followers, landing on Peru's coast in the early 1530's, found an already ancient Indian civilization. It was that of the great Inca Empire, born in the Andean heights of this mountain-tumbled country four centuries before (illustration, cover).

The Inca Empire was beginning to crumble at the very time of the Spaniards' invasion. The conquerors made the region that was to become the Republic of Peru a center of Spanish colonial power. From its mines they took millions of dollars' worth of gold and silver.

A Land of Many Faces

In modern Peru the mines of its mountain region are still a potent factor. Counting petroleum, minerals made up more than 60 per cent of the 1940 exports. To the long-mined precious metals are added the now doubly precious war materials —copper, lead, tungsten, antimony, and vanadium.

Yet Peru is by no means simply a "metal crop" country. Four-fifths of its roughly seven million people live by farming and stock raising. Wool from alpaca, sheep, and llama is one of the leading items on the export list.

To the traveler, Peru presents many faces, from hot, rain-drenched jungles to the cold heights of snow-topped Andes; from lush green valleys to barren, windy plateaus and rocky deserts. This country—which covers an area of nearly half a million square miles, or more than twice that of France—is divided into four great natural regions. Each is an adventure in geography.

Pacific Coast Productive Though Rainless

From its narrow rainless coastal ledge rises a broad mountain and plateau belt, with few passes below 15,000 feet and many peaks lost in clouds above 21,000 feet. Then to the east and northeast stretches Peru's frontier land—a potentially rich but still undeveloped region of hills and valleys. Finally come the torrid lowlands of the upper Amazon basin. Iquitos is the leading city of Peru's share of this Amazon basin region. Most of the cities, however, lie along the coast, like Lima, the capital (map, inside cover).

Geographers take special interest in the almost rainless stretches of the coast. The dryness is caused by two factors—high mountains which bar rain-carrying winds from the east, and the cold Humboldt (or Peru) Current from the Antarctic, which chills approaching air masses and so prevents rain from the west. Years may pass with little or no rain on parts of this shore; freak cloudbursts bring floods that cause extensive damage.

It is an odd fact that Peru's desert coast is nevertheless its most productive farm region, yielding cotton and sugar, rice and tropical fruits. These crops are made possible through irrigation from streams that roll down from the mountains to the Pacific. Another advantage is the existence of guano, or manure, on near-by Peruvian islands, a striking example of nature's life-giving tie-ups. On the teeming fish in the Humboldt Current's waters live the myriad birds that inhabit

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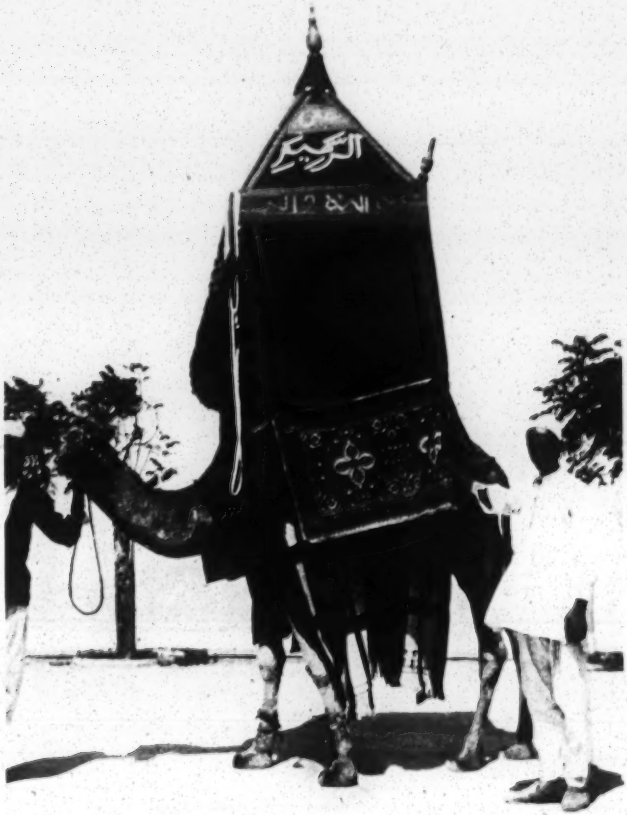
the troglodyte community grows as each family digs out a rock chamber that opens on the central shaft.

Farther south, in a semi-desert zone of steppe, the country is covered with feathery esparto grass, which the natives made into sandals and ropes and exported to Europe to make paper. In the great southern desert stretches live Berbers of the Tuareg tribe, where men instead of the women wear veils. The oasis cluster of Murzuch, in the Fezzan district, has been famous as a caravan stop. Gat and Gadâmes are important border oases, the latter an old town in Roman times.

Note: Tripolitania is shown on the National Geographic Society's Map of Africa. A price list of maps may be obtained from the Society's headquarters in Washington, D. C.

For additional information, see "Old-New Battle Grounds of Egypt and Libia," in the *National Geographic Magazine*, December, 1940; and these GEOGRAPHIC SCHOOL BULLETINS: "Bases and Battlefields Skirt Libia's Coast," January 11, 1943; and "U. S. Naval History Once Was Made at Tripoli," January 18, 1943.

Bulletin No. 1, January 25, 1943.



Riccardo Saver

HERE COMES THE BRIDE, IN A MOSLEM BLACKOUT

Among the Arabs living along the coast of Tripolitania, as well as in Cirenaica to the east, Moslem customs are strictly observed. While women generally are veiled, a bride is not only veiled but invisible, conveyed to her future home in a closed carriage or a high swaying palanquin on a camel's back. The marriage ceremonies have already been performed for the bride and groom separately, for her at her home, and for him at the mosque. The two will meet when the palanquin reaches the groom's home.

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Graphite for Writing and Fighting

A PENCIL makes its mark on paper by leaving a trail of tiny graphite particles. For the pencil "lead" is graphite, a distinct mineral with no chemical relationship to lead.

Discovery of a bed of pure graphite in England nearly four centuries ago marked the passing of real lead as a writing material. Now graphite is mixed with clay to make "leads" of different degrees of hardness for the more than a billion wood pencils made annually in the United States (illustration, next page). Yet in many languages, including English, Arabic, Dutch, German, Greek, Ethiopian, Japanese, and the Scandinavian, the graphite pencil is still misnamed "lead" pencil.

The Diamond's Soft-Hearted Black Cousin

Because this worldwide writing mineral is a fighting mineral as well, the U. S. needs an extra supply of it in wartime, especially of the flake graphite now difficult to import from Madagascar. Therefore the smudgy, shiny black flake graphite will soon be produced from the hills of eastern Pennsylvania, near Chester Springs, 30 miles northwest of Philadelphia. The mining and milling equipment is government-owned. Output will be restricted to war uses.

One of the softest of minerals, graphite is chemically the same as diamond, the hardest. Both are forms of carbon. Because the soft graphite, however, will not fuse with metals, no matter how hot, it has many industrial uses.

Graphite is abundant in many parts of the world. The U.S.S.R., Germany, Korea (Chosen), and Mexico produce more than four-fifths of the world's annual output of 200,000 tons. Most of it is a low-grade black powder, suitable for paint pigments, stove polish, and foundry facings (the linings for molds into which molten metal is poured).

The aristocrat of graphites is called flake graphite because of the flake form of its crystals. One-tenth of the world's total is higher-grade crystalline graphite that comes from Madagascar and Ceylon. This small fraction is worth nearly as much as all the rest together. Madagascar has a deep, 400-mile belt of flake graphite which is needed, wherever steel is made, for furnace crucibles and for stoppers in the giant ladles that pour molten steel. Ceylon's graphite, also of premium value because of its large crystalline form, is used in making crucibles, as a lubricant, and as top quality pencil "leads."

New Inventions Use Graphite for Radio and Bearings

Because it will not unite with other materials even at very high temperatures, more than half the graphite mined is used in crucibles and molds, and elsewhere in the steel industry where it comes into contact with hot metals. New uses constantly are found, as in two infant sciences—powder metallurgy and electronics. Powder metallurgists have developed a hard, tough composition material for bearings, gears, and other moving parts of machinery by compressing and sintering (heating just short of melting) mixtures of powdered iron and graphite. The material can be molded into finished parts that need no machining. The graphite makes such bearings self-lubricating. The "brushes" of motors and generators are similarly molded mixtures of graphite and powdered metals, such as copper and more recently silver, which is now coming into use. Graphite is useful in

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these islands; in turn their guano provides fertilizer for man's farm use.

Many evidences of Peru's dramatic past persist. Still strong is the influence of the Incas whose genius once spread their power from Cuzco, in southern Peru, over much of western South America. They built roads, bridges, and aqueducts, and massive stone forts and temples. They developed farming, terracing mountainsides and constructing irrigation works. Notable are the sturdy Inca remains at Cuzco and around high Lake Titicaca, and at the famous fortress-city of Machu Picchu, which was discovered only in 1911 and unearthed by expeditions of the National Geographic Society and Yale University.

Modern Peru is a striking combination of its Spanish and Indian elements. More than half of the nation's inhabitants are estimated to be pure-blooded Indians. Another 30 per cent or so are of mixed Spanish and Indian blood, with the rest of pure Spanish and other European stock, plus a few Negroes and Orientals. Japanese, according to recent estimates, number more than 25,000, and form the largest of the alien groups. Settled chiefly along the coast, many of them have been removed from the vicinity of such important areas as petroleum fields and airports and factories.

Note: Peru is shown on the National Geographic Society's Map of South America.

For further information on Peru, see these articles in the *National Geographic Magazine:* "The Pith of Peru," August, 1942; "Incas: Empire Builders of the Andes," February, 1938*; "Forgotten Valley of Peru," January, 1934; "Air Adventures in Peru," January, 1933*; "Lure of Lima," June, 1930*; and the following GEOGRAPHIC SCHOOL BULLETINS: "Revival of Inca Empire Proposed," January 9, 1939; "Lima, Peru: Grandmother of American Capitals," December 5, 1938. *(Issues marked by an asterisk are included in the special list of Magazines available to teachers at 10¢ each in groups of ten.)*

Bulletin No. 2, January 25, 1943.

Ewing Galloway

THIS MOUNTAIN-HOPPING TRAIN CLIMBS HIGHER THAN THE AVERAGE PLANE

Peru's Central Railway, running inland eastward from Callao and Lima, climbs the abrupt mountain wall of the Andes and crosses the Continental Divide at 15,865 feet, the highest altitude reached by any standard gauge train. The average commercial plane in non-mountain country, by contrast, operates at altitudes around 6,000 feet, although in Peru airlines also reach peak-clearing heights. At the end of its first 100 miles eastward, this railway is 3 miles higher than when it started. It dives through mountains and hops chasms by 65 tunnels and 67 bridges, like the Viscas Bridge above, which is 15,100 feet above sea level.

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Somaliland Switches to the Fighting French

LAST of France's once vast overseas empire to maintain ties with the Nazi-dominated Vichy government, barren French Somaliland, on Africa's northeast coast, has followed tiny Réunion Island's lead and transferred its allegiance to the Fighting French.

Far removed from African battlefields in Tunisia and Tripolitania, this small colony, about the size of New Jersey, has a 180-mile coast line along the important Strait of Bab el Mandeb and the Gulf of Aden. This water bottleneck at the south end of the Red Sea ranks after Gibraltar and Suez as a point for controlling through-Mediterranean shipping. The French colony's 8,400-square-mile area forms a pivot for the fan shape of Ethiopia, with Italian Eritrea projecting to the northwest and British Somaliland to the southeast as the fan's end sticks.

Ethiopia's Gateway to Sea Lanes

Front door for the commerce of landlocked Ethiopia, French Somaliland kept its garrisons alert when Italian invaders overran Ethiopia in 1935. Late in 1939 when an Italian army massed on French Somaliland's western border, France stationed warships and additional troops around Djibouti, the capital city.

Djibouti is the only French port in a 5,000-mile reach of African coast line from Tunisia to Madagascar. Its splendid harbor—the best in the adjacent 1,500 miles of northeast African shores—has given the city increasing importance throughout its 55-year history as a ship-coaling and servicing point for French traffic from Marseille to the Far East.

The Franco-Ethiopian Railroad, only rail outlet for Ethiopia, has its terminus at Djibouti and has contributed greatly to the port's importance. Built by degrees between 1898 and 1917, the line reaches 486 miles inland and 8,100 feet upland to Addis Ababa, Ethiopia's capital. Once it carried most of Ethiopia's exports of coffee, ivory, hides, and wax. In 1938 this transit trade through French Somaliland was six times more valuable than the colony's own exports.

Somali Coast Produces Salt and Pearls, but Little Food

French Somaliland is largely sun-baked sand, its somewhat hilly coast rising to a 4,000-foot plateau that extends to the highlands of Ethiopia. Although very dry, the climate is not unhealthful. Meager crops of coffee and cotton are produced, as well as a few European vegetables. Date and coconut palms and fruit trees grow there. Foodstuffs are an important item on the colony's import lists, and cotton goods, ironware, and coal for supplying ships must also be brought from abroad. Hides, coffee, and salt are the chief exports.

The chief geographic feature of the small and barren colony is its great gulf. Cutting a sharp angle into French Somaliland's eastern coast, the Gulf of Tadjoura forms a triangle whose westernmost point, 36 miles inland from the Gulf of Aden, opens into the circular bay of Ghubbet Kharab (Hell's Mouth). West of this bay the land is a desolate expanse of volcanic rocks.

The only industry yet developed in French Somaliland is the production of salt, which has been collected there since 1912. Some pearl fishing is carried on off the north coast, in the waters of the 100-mile-wide Strait of Bab el Mandeb.

The colony's population of about 50,000 includes 28,000 Somalis, 12,000 Danakils, 4,200 Arabs, and some 700 assorted Ethiopians, Hindus, and Jews. With

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the brushes because it is a good conductor of electricity. For the same reason, it is now replacing metal in electronic tubes, such as radio tubes. The glass of the tube is dipped in colloidal graphite, consisting of microscopic graphite particles suspended in water. The water dries, leaving a thin graphite film that serves the same purpose as the metal tube shield well known to radio amateurs. It would take a million of these graphite particles arranged in a solid line to measure one yard.

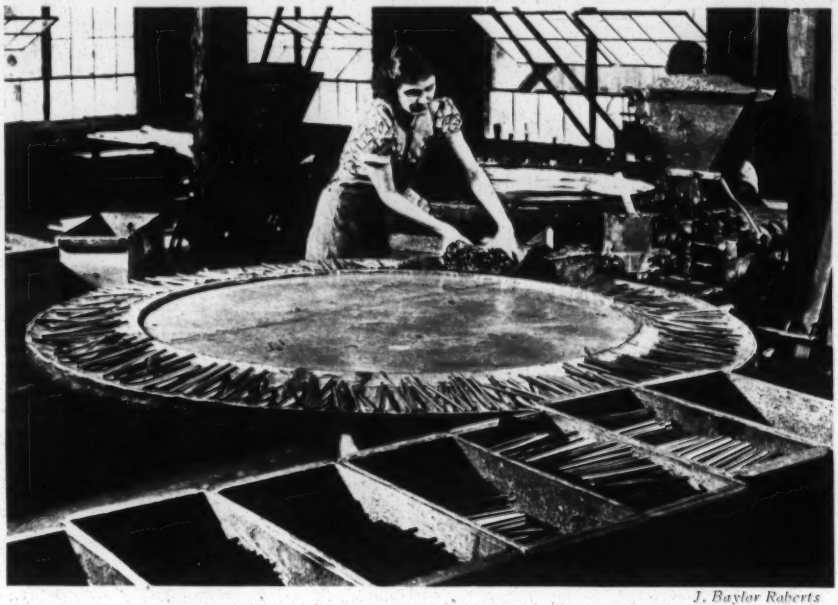
Colloidal graphite, with the tiny particles suspended in oil instead of water, gives long-lasting qualities of self-lubrication to metal bearings. Used as a dip, it increases the life of tools used in handling hot steel forgings. It stands heat that oil cannot endure. In making high-quality steel from scrap, graphite is used to insure the proper carbon content.

In 1941, when war stopped publication of figures, the U. S. imported twice as much graphite as in 1937, 22,500 tons from Mexico alone. Mining in the Guaymas district of Sonora, 200 miles south of the Arizona border, has been rapidly developed.

Sizable graphite deposits exist in Alabama, Texas, New York, Montana, California, and Nevada, in addition to Pennsylvania. Three new mills have been authorized for construction in central Alabama, largest source of American production in the early years of this century.

Note: For information on the use of metals in war, see "Metal Sinews of Strength," in the *National Geographic Magazine*, April, 1942.

Bulletin No. 3, January 25, 1943.



J. Baylor Roberts

THE PENCIL NAMED GRAPHITE, BUT LEAD NAMED THE PENCIL

Graphite gets its name from the Greek word meaning "to write," for it has long been the business end of writing implements such as the "lead" pencil. That it was believed to be lead, in fact, is shown by the aliases it has brought down from the past: "black lead" and "plumbago." A tenth of the graphite imported by the United States, mainly that from Ceylon, goes into pencils. A tenth of them are made in Shelbyville, Tennessee, where three pencil factories encase thin cylinders of graphite mixed with clay in wooden shells of cedar. After being painted by machinery (right), the fresh new pencils are deposited on the slowly revolving drying table. When it has carried them around once, they are dry enough for the girl attendant to remove.

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Geo-Graphic Brevities

GASOLINE A YOUNG PROBLEM CHILD OF OLD OIL INDUSTRY

GASOLINE, now a problem to the United States' 30 million rationed automobile owners because of its scarcity, was once a problem to oil refiners wondering how to get rid of it. Until the first of this century there was little market for it. It was a waste product of kerosene oil refining, and, believe it or not, was dumped into rivers, poured over open fields and burned.

A slight demand was created when the first gasoline-driven automobiles sputtered along American streets in the 1890's. The motorist then backed up his car to a drug or grocery store for a few quarts of his motor fuel, or hailed a passing tank wagon. The first filling stations appeared early in the 20th century, but even in 1910 gasoline was still an unimportant kerosene by-product.

The automobile "made" gasoline. As the auto industry grew, so grew the demand for gas. At the peak of consumption, with many of the nation's street corners occupied by filling stations and curbs lined with parked cars, one gas pump operated for approximately each 16 cars. The gas-hungry U. S. used some 70,000,000 gallons a day, enough to drive one mechanized army division several thousand miles.

Parent of the growing young gasoline industry is petroleum, used for thousands of years. Asphalt, a solid form of petroleum, was used as mortar in building the Tower of Babel. American Indians used oil for medicine.

Note: For additional information on gasoline, see "Today's World Turns on Oil," in the *National Geographic Magazine*, June, 1941.*

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ITALY LACKS RAW MATERIAL FOR WAR MACHINE

AS ALLIED bombers continue to batter the cities and the ports of Italy, that country is threatened with even greater shortage of raw materials for war.

Italian coal mines, in the Apennines and at the base of the Alps, before the war yielded only about 2,000,000 tons a year. Then Italy looked to Germany for about half her fuel needs (some 7,000,000 tons a year), to England for a fourth. Much of it was imported by water. Britain's blockade has necessitated bringing German coal by rail, burdening railways through the Alps. Italy has tried to repair her fuel shortage by developing water power (illustration, next page).

Italy has had to look abroad for three-fourths of her iron. Mines on the islands of Sardinia and Elba have been chief sources of the domestic one-fourth. Imports of iron and steel from Germany have kept up Italian industry—often $15,000,000 worth in a year. From Germany also came machine tools, agricultural and textile machinery, and motors, their value amounting to $25,000,000 in a year.

Italy has been second only to Japan in buying scrap iron and steel. In the six months before her entry into the war, she purchased from the United States 50 per cent more than in 1939—a record-breaking year for Italy's steel output.

With these materials Italy has maintained many industries. From Milan came locomotives, railroad cars, automobiles, telephone and telegraph apparatus, and precision instruments for scientist and surgeon. Turin was a center for manufacturing automobiles, trucks, aircraft, and high explosives. A newly-developed industry produced such chemicals as sulphuric acid and copper sulphate.

Italy's most important pre-war industry was the manufacture of textiles.

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few exceptions, the 2,000 Europeans are numbered among the 20,000 residents of Djibouti. Of these about 1,000 are French.

Obock, Once Capital, Dwindled to Village

Djibouti is the only city in the colony. North of the capital, across the gulf, stands the village of Obock, on a small bay curving in from the northern shore of the Gulf of Tadjoura. This was the point from which French acquisition of the rest of the colony expanded. Capital of the French Somali coast until the railway to Addis Ababa caused the transfer of the government to Djibouti, Obock has dwindled from a town of 5,000 inhabitants to a sprawling hamlet of palm-thatched native huts. Here was stationed a detachment of Somali soldiers.

At Tadjoura, a village on the Gulf of Tadjoura, about midway between Obock and the Ghubbet Kharab, a small garrison was stationed—a few native soldiers and two or three French officers. Houses built in Arab style and native brush huts with pointed-arched roofs, each with its encircling fence of branches, shelter the few inhabitants.

Note: French Somaliland is shown on the National Geographic Society's Map of Africa.

For additional material on the French colonies, see these articles in the *National Geographic Magazine*: "*Pilgrim* Sails the Seven Seas," August, 1937*; "Time's Footprints in Tunisian Sands," March, 1937*; "By Motor Trail Across French Indo-China," October, 1935*; "Secrets from Syrian Hills," July, 1933*; and "Sailing Forbidden Coasts," September, 1931.*

See also these GEOGRAPHIC SCHOOL BULLETINS: "Réunion Island, Isolated Bit of France in Indian Ocean" (Geo-Graphic Brevity), January 11, 1943; "France in Two Hemispheres: World's Second-Largest Empire," November 25, 1940; "French Somaliland Extends Strategic Border," March 13, 1939; and "Somaliland Is France's 'Railroad Station' Colony," January 16, 1939.

Bulletin No. 4, January 25, 1943.

Holmes from Galloway

HE MAKES A V FOR VICTORY IN BUSINESS, TOO

The dark Somali lad with the bright smile stands his best chance of learning a trade by playing around adult workmen, since education is limited in French Somaliland. The public school at Djibouti is the only one in the colony. On the sidewalk spot that constitutes a Djibouti outdoor tailor shop, the child plays with an imported American sewing machine, its metal parts shielded with cloth from the hot sun; otherwise, it might become too hot to touch. His two-fingered gesture, probably copied from that of his elders bargaining over prices, is apparently what he considers the key to a successful transaction.

Silk culture has flourished for generations in Lombardy, Piedmont, and Venetia. Cotton manufacture centered at Milan.

* * * * *

SUCHIATE RIVER GETS ANTI-SUBMARINE BRIDGE

FIGHTING submarines with a bridge is something new in warfare. The half-mile-long span recently completed across the Suchiate River, boundary stream between Mexico and Guatemala, enables shipments between Latin American states and the United States to move by rail, by-passing the U-boat menace.

Previously, Mexican rail traffic had come to a dead end in the port of Suchiate. Guatemalan rails had reached Ayutla, on the opposite side of the river. Northbound freight had to be unloaded onto oxcarts at Ayutla, pulled a mile to the river bank, and transferred to small barges (each with a maximum capacity of about a ton). Ferried across the Suchiate, the freight was trucked to the Mexican rail terminal. The ferries transported 40 or 50 tons a day.

As shortages of essential materials from Central and South America multiplied in the U. S., and sea losses climbed, need for a safe land route spurred construction of the bridge. When it was completed, 300,000 bags of coffee were piled on the Guatemala side awaiting shipment to the U. S. Because the railways are standard width on one side and narrow gauge on the other, the bridge carries three rails, to accommodate trains from both systems.

Bulletin No. 5, January 25, 1943.

De Cou from Galloway

POWER PLANTS HELP FUEL-POOR ITALY TO "BURN" WATER INSTEAD OF COAL

Without coal to stoke railroad engines or to generate power for factory machinery, Italy converts the water power of mountain streams into electricity for these duties. Many of the railways are electrified. The nation's largest lake, Garda, and its companion Lake of Ledro, higher in the mountains, cooperate to produce power. Water from Ledro pours down the mountainside in two penstocks (the big pipes, left background) to a power plant beside Garda, where it turns dynamos that generate electricity. Two-masted fishing boats in front of the power-plant and rowboats in the foreground show that the lake also serves for business and pleasure.